

The Prior Art Rejection

All of the claims in issue (claims 5 – 14) stand rejected under 35 USC §103 as being obvious based on US Patent 5,320,677 to Baig in view of US Patent 3,835,219 to Jaunarajs et al. Starting at page 3, the Examiner has reiterated the rejection set forth in the Office Action of October 19, 2005. All of the claims in the case require heating a slurry of water, gypsum and a cellulosic fiber, under pressure, to form acicular calcium sulfate alpha hemihydrate crystals; dewatering the slurry to form a composite product before rehydrating the hemihydrate back to gypsum. Claims 5 - 8 further require **aluminum chloride** or **chlorine** to be added to the slurry that is fed into the autoclave to increase the aspect ratio of the acicular calcium sulfate alpha hemihydrate crystals. Claims 9 through 14 require **alum** to be added to the slurry that is fed into the autoclave to increase the aspect ratio of the acicular calcium sulfate alpha hemihydrate crystals.

Claims 9 through 14 further stand rejected under 35 USC §103 as being obvious based on US Patent 5,320,677 to Baig in view of US Patent 3,835,219 to Jaunarajs et al and a 1995 paper by Spiring. Starting at page 9, the Examiner has reiterated the rejection of the Office action of October 19, 2005. Claims 9 through 14 further require the aspect ratio of the hemihydrate crystals emerging from the autoclave to be maintained above some selected level by continuously monitoring the aspect ratio of the hemihydrate crystals and adjusting the level of the alum going into the autoclave to maintain the aspect ratio above the selected level.

BAIG

US Patent 5,320,677 to Baig discloses the process set forth in the preamble portion of all of the applicants' independent claims. The Baig process includes 4 essential steps that are set forth in the preamble of the independent claims. First, a slurry of water, gypsum and cellulose fiber is heated under pressure to form acicular calcium sulfate hemihydrate crystals. Second, the slurry is dewatered. Next, the dewatered slurry is shaped. Finally, the hemihydrate crystals in the shaped slurry are rehydrated back to gypsum. All of these steps are required by all of applicants' pending claims.

As the Examiner pointed out at pages 3-4 of the Office Action, Baig suggests the use of organic acids as crystal modifiers. The only mention of crystal modifiers in Baig occurs at Col. 6, lines 42-45, where Baig states that "organic acids" can be added to the slurry can "to stimulate or retard crystallization or to lower the calcining temperature." In other words, Baig suggests that crystal modifiers may be used to lower the calcination temperature or speed up the calcination process. Clearly, Baig was referring to time required for the crystal formation and/or the temperature at which the crystals are formed. Baig does not suggest the organic acids increase the aspect ratio of the hemihydrate crystals or affects the aspect ratio in any manner. Baig does not mention any of the crystal modifiers recited in applicants' claims, namely aluminum chloride, chlorine or alum, as crystal modifiers or for any purpose.

Baig does not discuss the aspect ratio of the acicular calcium sulfate hemihydrate crystals being produced. Baig does not refer to any problems caused by low aspect ratio crystals or provide any reason for increasing the aspect ratio of the crystals being produced. Baig's principal concern was the growth of calcium sulfate hemi-hydrate crystals in a media that contained a significant quantity of cellulosic fibers. Baig states "As saturation of the solution is reached, the hemihydrate will nucleate and begin forming crystals in, on and around the voids and along the walls of the host fibers." (Col 6, lines 66-68) Although Baig refers to the calcium sulfate hemihydrate crystals as "acicular" Baig does not discuss the aspect ratio of the hemihydrate crystals. In fact, the only mention of "aspect ratio" in the Baig patent is in relation to the aspect ratio of wood fibers (See Col 14, lines 18-19). It is submitted that Baig does not teach one skilled in the art that aspect ratio of the calcium sulfate hemihydrate crystals has any significance for any purpose. It follows that Baig does not suggest the use of crystal modifiers to increase the aspect ratio of the calcium sulfate hemihydrate crystals.

At page 13 of the Office Action, the Examiner has outlined his view of applicants' arguments with respect to the 35 USC §103(a) rejections. The Examiner (Page 14) argues: "Baig teaches that crystal modifiers, such as for example organic acids, can be added to the slurry while being agitated in the pressure vessel to stimulate or retard crystallization or to lower the calcining temperature (column 6, lines 41-58). Since crystallization is growth of crystals, controlling the crystallization includes controlling the growth".

It is submitted that the Examiner's position is in error. Those skilled in the art of crystal formation know that "crystal modifiers" can affect three parameters, namely: the time required for crystal formation, the temperature at which the crystals are formed and the shape or morphology of the crystals that are formed. The morphology of the crystals includes the lattice symmetry, optical orientation, water of crystallization, density, hardness and a host of other parameters, in addition to aspect ratio. Ullmann's Encyclopedia of Industrial Chemistry. 5th Edition. VCH Publishers, 303 N.W. 12th Avenue, Deerfield Beach, FL 33442-1705. Calcium Sulfate, Vol. A4. Table 2. Physical Properties of the $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$. Page 558.¹ .

Applicants are providing herewith the Declaration of Paul J. Henkels, an expert with many years of experience in calcium sulfate crystallization processes including processes that employ crystal modifiers. Mr. Henkels states (paragraph 7) that Baig does not teach crystal modifiers that increase the aspect ratio of calcium sulfate crystals. Mr. Henkels goes on to say (paragraph 10) "It is well known to those skilled in the art that "organic acids" (such as those mentioned in the Baig Patent) and their salts cause the formation of short blocky crystals (low aspect ratio) of calcium sulfate hemihydrate in crystallization processes."

At the time of the Baig invention, it was well known that "organic acids" and their salts caused the formation of short blocky crystals (low aspect ratio) calcium sulfate hemihydrate in such processes. For example U.S. Patent 2,448,218 (1948) to Haddon states:

¹ A copy of Page 558 of Ullmann's is attached hereto

"It has long been known that various carboxylic acids, and the soluble salts thereof retard the setting of plaster (compare Gibson and Johnson J, S, C. 1, Jan. 22, 1932, vol, LI, No.4, 25T-38T).

"I have discovered that if the autoclaving of ground gypsum is performed in the presence of water in the liquid state and some of these carboxylic acids, and their soluble salts, a much squatter crystal of hemihydrate; is obtained and after rapidly filtering and drying (taking care to prevent setting as a result of permitting the solution to cool), much less water is required for gauging than if the gypsum were autoclaved in water only. The water required for gauging can be further reduced by suitable regrinding by methods known to the trade. (Col 1, lines 43-54)

At Col. 2, lines 4-17, Haddon goes on to say:

"The carboxylic acids suitable for the process are those which contain at least two carboxyl groups separated by two carbon atoms, with the qualification that if a double bond occurs between the intervening carbon atoms the cis form (e. g. maleic acid) is suitable, but the trans form (e. g. fumaric acid) is not. Examples of acids which I have found particularly suitable for the process are succinic and citric acid, and very good results have also been obtained with maleic and malic acid. Other examples are dextro and meso tartaric acid, racemic acid and aspartic acid.

Clearly, Haddon teaches those skilled in the art that the organic acid modifiers suggested by Baig would reduce the aspect ratio of the hemihydrate crystals and would not increase the aspect ratio, as required by applicants' claims.

Haddon also refutes the examiner's argument that "controlling the crystallization includes controlling the growth" in that Haddon addresses the difference between formation of crystal shape or habit form and the rate of crystals formation. At col. 2, line 18 Haddon states: "The effect on the modification of crystal shape bears no direct qualitative relation to the retarding effect. Thus succinic acid has a most potent effect on crystal shape produced by autoclaving, but is only a very mild retarder of setting, while tannic acids are powerful retarders, but exercise a much less powerful effect on crystal

shape." This is a clear teaching that there is a difference between the formation of crystal shape or habit and the rate of formation of the crystals. More importantly, Haddon is a teaching that a crystal modifier that affects the rate of crystal growth does not necessarily affect the shape of the crystals and visa-versa.

Mr. Henkels concludes (paragraph 9): "Persons skilled in the art understand that most crystal modifiers that impact on the aspect ratio of calcium sulfate crystals tend to produce short, blocky crystals having low aspect ratios. Those skilled in the art know that the longest crystals having high aspect ratios are produced from pure aqueous suspensions containing no contaminating reagents. Accordingly, one skilled in the art would assume any crystal modifier added to a calcium sulfate crystallization process would produce shorter blockier calcium sulfate crystals, not crystals having increased aspect ratios."

JAUNARAJ'S ET AL

Jaunara's et al Does Not Teach Modifiers To Increase Aspect Ratio.

Jaunara's et al does not specify the function of any of the disclosed "crystal habit modifiers." The only statement in Jaunara's et al about modifier function is: "The suspension may also contain a small amount of a crystal habit modifier which is suitable for the formation of the fibrous soluble anhydrite. These are generally acids such as boric, succinic, adipic, malonic, sebacic, and similar acids or their salts, as well as salts such as sodium chloride, sodium sulfate, aluminum sulfate, and zinc sulfate." [Emphasis added]

(See Col. 3 lines 10-19) There is no suggestion in Jaunarajs et al that the modifiers will increase the aspect ratio of the crystals. In paragraph 12 of his Declaration, Mr. Henkels concludes: "Thus Jaunarajs et al actually teaches that the enumerated modifiers produce shorter, blocky calcium sulfate anhydrite crystals, not higher aspect ratio crystals as claimed by Miller et al."

In paragraph 13 of his Declaration, Mr. Henkels points out that the Jaunarajs et al examples illustrate that the preferred modifier (boric acid) actually produce calcium sulfate crystals have a lower aspect ratio than the equivalent examples run without any modifier. Clearly the "crystal habit modifiers" specifically disclosed by Jaunarajs et al are organic acids. (Col. 3 lines 13-14) All of the organic acids listed by Jaunarajs et al are dibasic acids that were well known before to produce "a much squatter crystal of hemihydrate;" that is a crystal having a very low aspect ratio, e.g. US Patent 2,448,218 to Haddon, discussed above.

Additional teachings of acids to form blocky crystals are, for example, US patent 2,907,668 to Nies et al (1959) where the "crystal-habit-modifier" is defined as "influence the formation of calcium sulfate hemihydrate crystals so that the shorter, wider and squattier type is formed." (Col. 7, lines 15-35). US Patent 2,913,308 to Dailey et al (1959) identifies "succinic acid" as a "crystal growth inhibitor", i.e. organic acid modifiers produce blocky crystals. (Col. 5, Line 42-44). US Patent 4,309,391 to O'Neill (1982) for "Lump process alpha gypsum", describes and claims the use of succinic acid as a crystal-habit-modifier. (See claim 6).

In response to applicants' assertion that Jaunaraajs et al fails to teach crystal modifiers to increase aspect ratio, the Examiner (Page 14) argues: "As Jaunaraajs teaches the size to grow to and the aspect ratio, the controlled crystallization would control growth. Since the fibrous length grows, the calculated ratio would increase accordingly." This assertion is in error and is refuted by the Henkels Declaration and the prior art such as US Patent 2,448,218 to Haddon.

Those skilled in the art are aware that the dibasic acids listed in Jaunaraajs et al are commonly used as crystal modifiers, but to force the aspect ratio to ***shorter and blockier*** crystals instead of the higher aspect ratio crystals sought by applicants. The use of additives to produce crystals of low aspect ratios are common in power plant recrystallization of calcium sulfite/sulfate to produce larger, blockier crystals that are easier to dewater in their water reclaim process. Accordingly, it is reasonable to conclude that Jaunaraajs used the crystal modifiers to avoid making calcium sulfate anhydride crystals longer than 150 microns (his maximum length) or crystals having an aspect ratio greater than 100:1 (his upper limit).

Jaunaraajs et al lists some inorganic modifiers including aluminum sulfate (the major component of alum). Jaunaraajs et al does not mention using aluminum chloride or chlorine as crystal modifiers or for any other purpose. At page 15, the examiner argues that aluminum chloride and chlorine are obvious crystal modifiers because Jaunaraajs et al also lists sodium chloride as one of the crystal habit modifiers. If one skilled in art were to assume that any source of chloride would affect the calcium sulfate hemihydrate crystal, calcium chloride should have a similar effect. However, as taught in US Patent 2,616,789

to Hoggatt (1952), calcium chloride is a modifier used to produce the shorter, blockier (lower consistency or water demand) calcium sulfate hemihydrate crystal. (Column 16, line 29-40) In paragraph 15, Mr. Henkels states "the prior art shows those skilled in the art that aluminum chloride and chlorine would produce a shorter, blockier calcium sulfate hemihydrate crystal, not the increased aspect ratio crystal required by claims 5 - 8 of the Miller et al application."

Those skilled in the art would understand Jaunarajs et al to teach that the "crystal habit modifiers" promote the formation of fibrous soluble anhydrite apparently "to the virtual exclusion of non-fibrous anhydrite, insoluble anhydrite, and/or hemihydrate". Like the Baig disclosure, Jaunarajs et al fails to suggest that these "crystal habit modifiers" have any impact on the aspect ratio of any type of calcium sulfate fibers.

The Jaunarajs et al Anhydrite Is Not Suitable For The Claimed Process.

US Patent 3,835,219 to Jaunarajs et al is directed to a method of selectively preparing fibrous soluble calcium sulfate anhydrite that avoids the formation of any calcium sulfate hemihydrate. The Jaunarajs et al process selectively produces anhydrite "to the virtual exclusion of non-fibrous anhydrite, insoluble anhydrite, and/or hemihydrate." (Col. 2, lines 18-20). The Jaunarajs et al method does not contemplate the formation of any type of calcium sulfate fibers in the presence of cellulose fibers, as required by applicants' claims. Jaunarajs et al also describes the use of "crystal habit modifiers" that are "suitable for the formation of the fibrous soluble anhydrite." (See Col.1, lines 66-67 and Col. 3, lines 11-12).

Those skilled in the art would recognize, however, that calcium sulfate anhydrite fiber produced by the Jaunarajs et al process would not be suitable for use in the Baig process. Calcium sulfate anhydrite is extremely slow to rehydrate. The last step of the Baig process, as set forth in applicants' claims, is to rehydrate the acicular calcium sulfate alpha hemihydrate crystals back to gypsum to bond the cellulose fibers into a composite material. As a practical matter, the rehydration step in applicants' continuous process must take place within a short time. Accordingly, the fibrous calcium sulfate anhydrite product of Jaunarajs et al would be difficult or impossible to use in the rehydration step of the Baig process defined by applicants' claims because the rate of rehydration must be synchronized with other steps of the process to achieve satisfactory final composite properties (e.g. see US Patent No.: 6,197,235 B1 to Miller (2001), Figure 6, Claim 9, 16, etc.).

The anhydrite fibers described by Jaunarajs et al are used to reinforce a variety of organic polymeric resins (Col. 4, lines 17 – 20). Fibers containing water (such as applicants' hemihydrate or any rehydrated version of these fibers) would not be suitable for use in organic polymers because water in the fibers would release water/steam during conventional polymer melting and molding operations and thus interfere with the properties and stability of the organic polymers. In other words, Jaunarajs et al teaches the production of fibers that can't be used in applicants' process and applicant prepares fibers that can't be used in place of the fibers described by Jaunarajs et al. Accordingly, those skilled in the art would not look to Jaunarajs et al to solve any problems encountered in practicing the Baig process.

In response to these arguments, the Examiner asserts (page 15) "it is noted that the features upon which applicant relies (i.e., melting and molding; fiber performance during melting and molding; and success in melting and molding) are not recited in the rejected claim(s)." It is submitted that the Examiner's argument is in error because all of the claims in issue require the hydration of the calcium sulfate hemihydrate back to gypsum.

The Examiner Relies Upon A Typographical Error In Jaunarajs et al

The Jaunarajs et al '219 patent repeatedly teaches a process to produce calcium sulfate anhydrite fibers. At page 15, the Examiner has cited Col 2 lines 38-39 of the Jaunarajs patent 3,835,219 and asserts that "Jaunarajs is relied upon to clearly teach forming fibers of soluble calcium sulfate hemihydrate." The Examiner has cited the only mention of calcium sulfate hemihydrate that appears in the '219 patent² and the text cited by the Examiner is at odds with the rest of patent 3,835,219.

Upon reviewing Jaunarajs et al patent 3,835,219, one skilled in the art would notice, for example, that the title that describes the "preparation of fibrous soluble calcium sulfate anhydrite." The disclosure of the '219 patent repeatedly describes "fibrous calcium sulfate anhydrite" as the object of the invention, see for example. Col. 1 lines 51-51, 55, and 69 and col. 2 lines 3-10. The wording in Column 2 lines 35-43 (cited by the Examiner) is identical to the wording in Column 2 lines 3-10 except that line 40 refers to hemihydrate instead of the anhydrite which is the focus of the rest of the disclosure.

² US Patent 3,977,890 to Jaunarajs et al teaches a method for preparing calcium sulfate hemihydrate.

Column 2 lines 18-20 of the Jaunarajs '219 patent state "fibrous soluble anhydrite may be produced to the virtual exclusion of non-fibrous soluble anhydrite, insoluble anhydrite and/or calcium sulfate hemihydrate." [Emphasis added] Jaunarajs et al makes it clear that the object is to make calcium sulfate anhydrite and in particular to avoid making any calcium sulfate hemihydrate. One skilled in the art would assume that if the object of the invention is to make anhydrite and exclude hemihydrate, that the method disclosed by Jaunarajs et al will achieve the goal and that no calcium sulfate hemihydrate would be generated. Finally, all of the Jaunarajs claims are directed to the production of an anhydrite. Accordingly it is submitted that one skilled in the art would view of the '219 patent as a teaching of how to make calcium sulfate anhydrite containing no hemihydrate. Again, those skilled in the art would not look to Jaunarajs et al to solve any problems encountered in practicing the Baig process.

THE SPIRING PAPER

The Examiner cites the Spiring paper to teach continuously monitoring a process ability/capability. The Spiring paper does not relate to processes to calcine gypsum or to any other aspect of the claims in issue. The Spiring paper teaches a statistical approach to process control and doesn't teach anything pertinent to Claims 9 through 14. Clearly, the Spiring paper does not overcome the failure of Baig in view of Jaunarajs et al to suggest the use of alum to control the aspect ratio of the acicular calcium sulfate alpha hemihydrate crystals being produced as required by applicants' claims.

In response, the Examiner asserts (page 15): "it is well known and recognized that the aspect ratio must intrinsically be monitored in some type of fashion in the process of Baig in view of Jaunarajs et al., even if not specifically stated, to assure that the aspect ratio is maintained in the desired and claimed range (e.g., 10:1 to 50:1)." The Examiner goes on to assert "applicant has not contested this position, which is independent of Baig and Jaunarajs's content, it is taken as concession."

Applicants have never conceded this point and Applicants' contest the Examiner's assertion that there has been any concession on this point. The Examiner first made the argument that "the aspect ratio must intrinsically be monitored in some type of fashion" in the Office Action mailed 4/14/05 at page 6. The applicants traversed the argument in Amendment A at page 13 and specifically amended the claims to require the process to be continuous and that the monitoring of the aspect ratio to be continuous. Baig describes a continuous process, but doesn't teach anything about aspect ratio or the use of aspect ratio to control any aspect of the process. The Jaunarajs '219 patent does not teach a continuous process and suggests nothing about continuously "monitoring" aspect ratio or the use of aspect ratio to control any aspect of a continuous process.

In the Office Action of 10/19/2005 (Page 11) the Examiner again made the argument that "the aspect ratio must intrinsically be monitored in some type of fashion" and the Examiner cited the Spiring paper to support this argument. The applicants again traversed the argument in Amendment B at page 15. Applicants said: "Clearly, the Spiring paper does not overcome the failure of Baig in view of Jaunarajs et al to suggest the use of alum to control the aspect ratio of the acicular calcium sulfate alpha hemihydrate

crystals being produced as required by applicants' claims". Thus, applicants' have traversed this argument each time it was raised.

The argument that "it is recognized that the aspect ratio must intrinsically be monitored in some type of fashion" is certainly not shown in the prior art and the citation of the Spiring paper does not overcome the failure of the prior art to make obvious applicants' claims. Clearly, the process disclosed by Jaunarajs et al is a batch process. Indeed, most processes designed to produce high aspect ratio crystallization calcium sulfate hemihydrate crystals are batch because of the sophisticated process engineering and controls required for continuous processes at elevated temperatures and pressures, where the friable high aspect ratio product can be easily damaged if explosively decompressed to atmospheric temperature and pressure. Decompression of the slurry containing the friable high aspect ratio product can be easily controlled in a batch process, whereas a continuous process requires sophisticated controls to avoid damaging the fragile high aspect ratio crystal product. Accordingly, most processes of this nature are batch processes wherein continuous monitoring is not required and is not used, as argued by the Examiner.

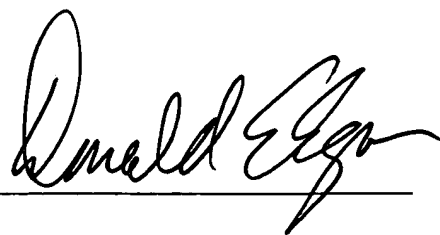
CONCLUSION

The prior art fails to suggest the use of aluminum chloride or chlorine to increase the aspect ratio of acicular calcium sulfate alpha hemihydrate crystals formed in a calcination process. Accordingly, reconsideration of the rejection of claims 5 through 8

under 35 USC §103 as being obvious based on US Patent 5,320,677 to Baig in view of US Patent 3,835,219 to Jaunarajs et al is requested.

The prior art also fails to suggest the use of alum to increase the aspect ratio of acicular calcium sulfate alpha hemihydrate crystals formed in a calcination process. As explained above, the prior art fails to suggest a process in which the selected aspect ratio of the hemihydrate crystals is maintained by continuously monitoring aspect ratio of the hemihydrate crystals in order to adjust the level of the alum going into the autoclave. Accordingly, reconsideration of the rejection of claims 9 through 14 under 35 USC §103 as being obvious based on US Patent 5,320,677 to Baig in view of US Patent 3,835,219 to Jaunarajs et al. It is submitted that the claims are patentable over the prior art. Reconsideration of all grounds of rejection is respectfully requested and an early notice of allowance is solicited.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Donald E. Egan", is written over a horizontal line.

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558 Calcium Sulfate

Table 2. Physical properties of the $\text{CaSO}_4 \cdot x\text{H}_2\text{O}$

Property	Calcium sulfate dihydrate	Calcium sulfate hemihydrate		Anhydrite III	Anhydrite II	Anhydrite I
		α -form	β -form			
Water of crystallization, wt%	20.92	6.21		0.00	0.00	0.0
Density ρ , g/cm ³	2.31	2.757	2.619–2.637	2.580	2.93–2.97	un
Hardness, Mohs	1.5	—		—	3–4	—
Solubility in water at 20 °C, g per 100 g of solution	0.21	0.67	0.88	hydrates to the hemihydrate	(0.27)	—
Refractive indices n_x	1.521	1.559*		1.501	1.570	un
n_y	1.523	1.5595*		1.501	1.576	
n_z	1.530	1.584		1.546	1.614	
Optical character	+			+	+	un
Optical orientation	$n_y \parallel b$ $n_{ye} = 52^\circ$	$c \parallel n_z$		$c \parallel n_z$	$n_x \parallel c$ $n_y \parallel c$	un
Axial angle $2V$	$58-60^\circ$	14°		$\approx 0^\circ$	$42-44^\circ$	un
Lattice symmetry	monoclinic	rhombohedral		hexagonal	rhombic	cu
Space group	$C2/c = C_{2h}^6$	$C3_2 = D_3^6$		$C6_2 = D_6^4$	$C_{2mm} = D_{2h}^{17}$	un
Lattice spacing, nm, a	1.047	0.683		0.699	0.696	un
b	1.515	0.683		0.699	0.695	
c	0.628	1.270		0.634	0.621	

* Average

and anhydrite III reacts readily with water vapor to form hemihydrate.

The β -hemihydrates from β -anhydrite III and β -anhydrite III' differ in their physical properties [22]. Therefore hemihydrates from β -anhydrite III' should be designated as β -hemihydrate'. α -Anhydrite III absorbs water vapor to form α -hemihydrate. Likewise, the hemihydrates, in humid air, reversibly adsorb up to 2% of their weight in water without converting to dihydrate. This nonstoichiometric water in the hemihydrate can be completely removed by drying at 40 °C.

Anhydrite II is formed at temperatures between 200 °C and 1180 °C. Above 1180 °C, anhydrite I forms; below 1180 °C it reverts to anhydrite II.

The dehydration kinetics of the dihydrate in contact with either aqueous solution [23] or a gas phase substantiate these reaction processes. However, all the hypotheses concerning reaction mechanisms, activation energies, and orders of reaction in the gaseous phase [24], [25] have not yet been proved consistent. The problems are that the kinetics of the phase changes are often inhibited and that

1.3. Industrial Dehydration of G

Industrially it is most important that dehydration is achieved in the shortest time with the lowest energy consumption, i.e., that the heat is held to a minimum. Because of kinetic considerations calcination is carried out at much higher temperatures than those used in the laboratory (Table 1). Rarely are pure phases obtained during manufacture; rather, mixtures of the $\text{CaSO}_4\text{--H}_2\text{O}$ system are obtained. Three types of calcined anhydrite II (called gypsum plaster or overburnt plaster) are manufactured, depending on burn temperature and time:

- 1) anhydrite II-s (slowly soluble anhydrite), produced between 300 and 500 °C
- 2) anhydrite II-u (insoluble anhydrite), produced between 500 and 700 °C
- 3) anhydrite II-E (partially dissociated anhydrite plaster, *Estrichgips*), produced above ≈ 700 °C

In use the difference among these types lies in the rates of rehydration with water. For anhydrite II-s is fast, for anhydrite II-u is slow, and for anhydrite II-E is intermediate, faster than anhydrite II-u (see Fig. 1).